PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
A61L 31/00, 29/00, 25/00, B32B 25/04, 25/08

A1

(11) International Publication Number: **WO 99/19006**

(43) International Publication Date: 22 April 1999 (22.04.99)

(21) International Application Number: PCT/GB98/03019

(22) International Filing Date: 8 October 1998 (08.10.98)

(30) Priority Data:
9721679.0 13 October 1997 (13.10.97) GB

(71) Applicant *(for all designated States except US)*: LRC PRODUCTS LIMITED [GB/GB]; North Circular Road, London E4 8QA (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: BRIGNOL, Céline [GB/GB]; 69 John Amner Close, Ely, Cambridgeshire CB6 1DT (GB). GIDNEY, Kevin [GB/GB]; 3 Royal Oak Cottages, Oak Lane, Rougham, Bury St. Edmunds, Suffolk IP30 9JX (GB).

(74) Agents: WAIN, Christopher, Paul et al.; A.A. Thornton & Co., Northumberland House, 303–306 High Holborn, London WC1V 7LE (GB).

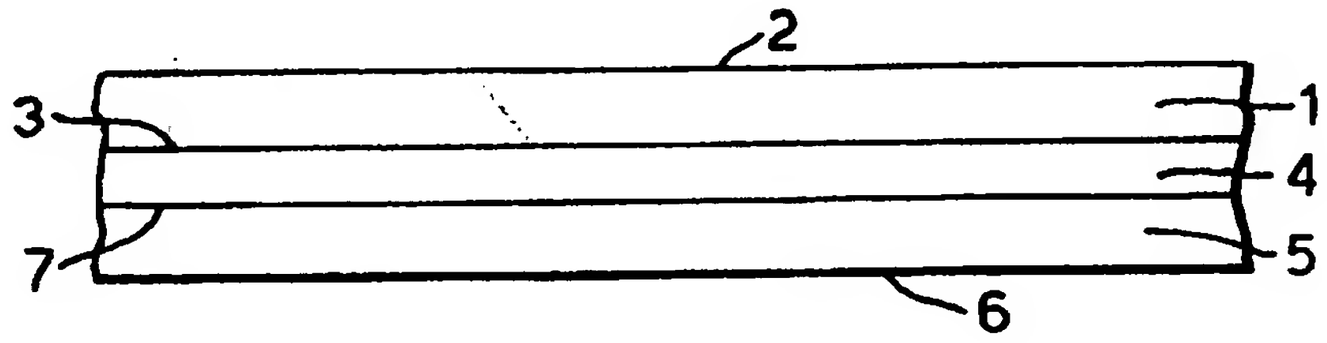
(81) Designated States: AU, CA, CN, JP, NZ, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: ELASTIC THIN–WALLED ARTICLES

(57) Abstract

The transmission of fluid and/or of disease through thin–walled elastomeric articles such as medical and surgical gloves is reduced or prevented by providing a layer (4) of a xerogel containing a protective agent, in the article. The xerogel layer (4) can be disposed between two elastomer layers (1, 5).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

ELASTIC THIN-WALLED ARTICLES

This invention relates to elastic thin-walled articles, particularly but not exclusively surgical and medical gloves and condoms, and to a method of making them.

Elastic thin-walled articles such as gloves and condoms serve to protect the user against inter alia the transmission of disease. There have been a number of proposals designed to improve the protection afforded by such articles. U.S. patent no. 5165953 discloses providing a chemical barrier in a latex material by coating a former with latex, applying a coating of biocide thereover, and then applying a second coating of latex. The biocide is thus sandwiched between the two layers of latex and is released upon rupture or piercing of the latex. In addition, the biocide will reduce or prevent transmission of microbes through the latex via any pores therein.

In U.S. patent no. 5483697, there is a similar approach but here a sealing solution is provided between two latex laminae, and this solution serves not only to contain a biocide (or other protective material) but also to seal up any ruptures or holes which are formed in use of the article. One of many possible sealing solutions comprises a hydrogel which is swollen with an aqueous solution of biocide or other protective agent. U.S. patent no. 5549924 also describes the

use of a double-layer membrane with biocide or another material in the reservoir formed between the two layers. One suitable material is a hydrogel which functions by absorbing the biocide to hold the membrane layers apart.

Whilst these proposals are to some extent satisfactory, there are disadvantages in having a swollen soft hydrogel (or other liquid containing material) between the two latex layers. Not only can this be difficult to manufacture, but it also can give rise to difficulties in controlling thicknesses etc. and there can be problems in achieving a satisfactory "feel" especially in surgeons' gloves.

We have now found a way of overcoming these problems. In particular, we have found that very satisfactory protective biocidal effects can be achieved by providing the biocide (or other agent) in a xerogel, i.e. in a hydrogel which is practically completely dry and unswollen. In this way, the various problems associated with the prior known use of water-containing hydrogels are avoided without loss of the biocide release requirement which is important to the protective functioning of the article.

It is surprising that a dry hydrogel layer, i.e. a xerogel, will function as well as (and in many respects better than) the prior taught wet swollen layers since it might be expected that a dry layer would not provide such good sealing or produce the necessary supply of active biocide. However, the xerogel layers of the invention not only are very effective but also give a number of other advantages.

In one aspect, the invention provides a thin-walled elastic article which comprises two layers of elastomer with a layer of xerogel containing a protective agent sandwiched therebetween.

The invention also provides a method of making such an article which comprises providing, between two layers of elastomer, a layer of xerogel containing a protective agent.

We have further found that it is also possible to achieve the aims of the invention by making a single layer elastomer article having a xerogel layer

(containing the protective agent) over at least part of one surface, and then using such an article with a second article (which need not have any xerogel layer), the second article (in use) lying over the xerogel layer of the first article.

Thus, the invention also provides a thin-walled elastic article which comprises a layer of elastomer with a layer of a xerogel containing a protective agent over at least part of a surface of the elastomer layer.

The invention further provides such an article in association with a second thin walled elastic article to be worn or otherwise used over or under the first article with the xerogel layer sandwiched between the elastomer layer and the second article.

This arrangement is particularly, but not exclusively, useful for gloves, and the invention thus provides a thin-walled elastic article comprising a layer of elastomer with a layer of a xerogel containing a protective agent over at least part of a surface of the elastomer layer, in the form of a glove, in association with a second article which is a thin-walled elastic second glove worn or to be worn over or under the first glove with the xerogel layer sandwiched between the elastomer layer of the first glove and the second glove.

In the two-piece assemblies of the invention, it is highly preferred that the two articles be a close snug fit together to cover or enclose the xerogel layer.

In the articles of the invention, the xerogel layer normally contacts the elastomer layer(s), and may be bonded thereto, but the invention also includes articles in which there are one or more other layers between the elastomer layer(s) and the xerogel layer. Where a second article is used comprising an elastomeric layer, this can be in direct contact with the xerogel or spaced therefrom by one or more other layers.

In the articles of the invention, the elastomer layers can be of the same or different materials. We prefer to use natural rubber latex layers, but other materials such as synthetic rubbers and other elastomers, eg. polyurethanes, can be

used. Normally, the articles of the invention will be made by dipping a former into solutions or dispersions of the materials to be coated thereon.

The xerogels used in the present invention must be capable of imbibing fluid upon exposure to water or physiological fluids in the event of rupture of the glove. We prefer to use synthetic polymers, or semi-synthetic polymers, eg. modified naturally occurring materials. Examples of preferred xerogels can include electrically neutral polymers or copolymers formed from monomers such as 2-hydroxyethyl methacrylate or similar hydroxy esters of methacrylic or acrylic acid, N-vinyl pyrrolidone, acrylamide, methacrylamide, N-isopropyl acrylamide or similar N-alkyl substituted derivatives of acrylamide or methacrylamide. Alternatively, the xerogels may be formed from acrylic polymers or copolymers containing charged ionic groups as a result of using salts of monomers such as acrylic acid, methacrylic acid, itaconic acid, vinyl sulphonic acid or acrylamido propane sulphonic acid in which case the xerogel polymer chains will be negatively charged. If quaternary ammonium salts of monomers such as N,N-dimethyl amino ethyl methacrylate or N-vinyl pyridine are used to form the xerogel, then the polymer chains will carry a positive charge. The xerogels to be used need not be restricted to acrylic polymers obtained by conventional free radical polymerisation but can also be based upon polymers or copolymers such as polyvinyl alcohol, polyethylene oxide or segmented polyurethanes having soft segments containing polyethylene glycol. In addition, semi-synthetic carbohydrate polymers such as hydroxyethyl cellulose, hydroxy propyl cellulose or salts of carboxymethyl cellulose and alginic acid may be used.

This list is by no means exhaustive and the polymer or copolymer of choice will depend upon the device to be constructed and the active ingredient to be used within the xerogel layer.

The xerogels may be thermoplastic or thermoset. However, in the case of cross-linked xerogels, the cross-linking must not be so great that the polymer loses its ability to imbibe or absorb fluid. The absorbtion of fluid by the

xerogel on rupture of the article is important in a number of respects. For example, as the xerogel contacts physiological (or other) fluid it will swell and, in so doing, will serve at least partly to seal up any rupture in the article and so confine the damage. Further, the biocide (or other active material) in the xerogel can be activated by contact with the fluid and will then act in the vicinity of the rupture to contact infectious microbes and the like. Further, the biocide can spread through and into the physiological fluid in the vicinity of the rupture to provide a zone of treatment.

The protective agent in the xerogel layer in the articles of the invention can vary widely and may be, for example, a biocide, a virucide, a bactericide, or a spermicide. Other active agents can also be used. The agents can be used singly or in any mixture of two or more thereof.

The amount of protective agent present in the xerogel will most preferably be sufficient to provide the desired effect when released upon rupture of the article. The actual amount used will depend on the material and the effect required but can be determined by routine experiment in any particular case. In general, we prefer that the xerogel layer contains, by weight, from 0.1% to 80% protective agent. In the case of biocides, for example, we prefer to use from 1% to 80%, and preferably from 2% to 75% by weight of the xerogel layer.

In many cases, it is useful to the user of an article of the invention to know that a rupture has occurred. For this purpose, a dye or other indicator can be incorporated in the article, for example, so that there is a colour change or release when rupture occurs. The dye can be in the xerogel layer, for example. Some biocides are themselves dyes and, in such cases, can provide a visible indication of rupture. Another form of indication is to rely on detection of the swelling of the xerogel layer upon contact with fluid.

The invention is of particular utility for condoms and for medical and surgical gloves, but can also be used in diaphragms, speculum sheaths, endoscope tubing, catheters, shunts, colostomy bags, food storage and packaging materials.

In order to make the articles of the invention, it is necessary to provide a layer of xerogel containing biocide (or other protective agent) between the two layers of elastomer. The xerogel layer must preferably be completely sealed within the article so that it will only contact fluid when some fault, eg. rupture or holing, of the article occurs. We prefer to make the articles by the well known dipping procedures. However, some modification of these procedures may be needed in order to be sure that the xerogel is substantially water-free.

In accordance with one preferred procedure, suitable for example for making condoms or gloves, a solution (or dispersion) of the xerogel in an organic solvent (in which its swelling is nil or negligible) is used. The solution will also contain the protective agent dissolved or suspended therein. Once a layer of the solution has been applied to the elastomer layer, a second elastomer layer can be applied thereover and the solvent and any fluid phase of the second elastomer layer simultaneously removed. Thus, for example, a former may be dipped in an aqueous rubber latex to form thereon the first elastomer layer and, after drying, the former can be dipped in (or sprayed or otherwise coated with) the organic solvent solution or dispersion of the xerogel and active agent. The article can then be dried and removed from the former (if it is to be used in association with a second article), or it can be coated by dipping the coated former into aqueous rubber latex again to provide the second elastomer layer. The coated former is then heated to drive off the solvent from the xerogel layer and the water from the second elastomer layer.

The second articles used in association with first articles of the invention will normally be made in the same way (so that they have the same shape) but will normally not have any xerogel coating.

In order that the invention may be more fully understood, reference is made to the accompanying drawings wherein:

Figure 1 is a cross sectional view of the material of one example of a surgeons' glove of the invention;

Figure 2 is a plan view of a surgeons' glove having an outer xerogel coating; and

Figure 3 is a plan view of a surgeons' glove for use with the glove of Figure 2.

Referring to Figure 1, the material comprises a first layer 1 of latex, one surface 2 of which forms the outer surface of the glove and a second layer 5 of latex, the outer surface 6 of which forms the inside surface of the glove. Sandwiched between the other surface 3 of the layer 1 and the other surface 7 of layer 2, is a layer 4 comprising an intimate mixture of a xerogel and an active agent eg. biocide. This layer 4 is dry and is maintained dry by the two layers 1 and 5 of latex material. If, however, either or both layers of latex are punctured or ruptured, fluid can enter the material and, upon contact with layer 4, will cause the xerogel to swell and become biologically active.

In the case of a surgeons' glove, the total thicknesses of the material (including any other layers present) will be from about 125 to 300 micrometres of which the xerogel layer will be about 25 - 60 micrometres thick. These thicknesses are given by way of illustration and not limitation.

Figure 2 shows a surgeons' glove 8 which is in the usual shaped, handed form for snug fitting on the hand. Glove 8 comprises a layer of latex rubber 9 with an inner coating 10 of a xerogel layer containing a biocide. The coating layer 10 is shown in the Figure although, since it is on the inside of the glove, it would not normally be visible.

Figure 3 shows a surgeons' glove 11 comprising a layer of latex rubber 12, which glove is identical to, or very slightly larger than, the glove 8 of Figure 2 but has no xerogel layer.

In use, glove 11 is first donned and then glove 8 is donned over glove 11. The coating 10 is thus sandwiched between the latex rubber layer 12 of glove 11, and the latex rubber layer 9 of glove 8.

As illustrated, glove 8 is inside out to show the inner coating.

Among the preferred features of the gloves of the invention are that:

(a) the biocidal activity is completely suppressed under normal glove use until breach of one or both of the elastomer layers occurs;

(b) the biocidal activity commences at the moment breach occurs as fluid contacts the xerogel;

(c) the doses of biocide within the xerogel in the region of any breach can be high enough to kill any foreign organisms very quickly; and

(d) the wearer of the glove can have an indication both that breach has occurred and of the location of the breach.

In order that the invention may be fully understood, an embodiment thereof will now be described by way of illustration only.

In this embodiment, there is described the preparation of a layer of xerogel, containing a biocide, sandwiched between two thin films of natural rubber, the second film having been prepared separately without a xerogel/biocide layer. For this purpose, the proprietary two-part hydrogel Aquatrix II (Trade Mark of Hydromer Inc. of Branchburg, N.J., USA) was used to provide the xerogel. Chlorhexidine digluconate was used as the biocide.

Natural rubber latex was compounded for vulcanisation by the addition of suitable quantities of sulphur, an organic accelerator, and zinc oxide, according to well-known methods. The compounded latex was prevulcanised by a period of heating at 50 degrees C and was then cast on a glass plate and spread by means of a K-bar to give a thin film having a thickness of 100 micrometres after drying.

A quantity of Aquatrix II, Part A was mixed thoroughly with one tenth of its weight of biocide and one fifth of its weight of glycerol (a plasticiser for the dried xerogel film). A quantity of Aquatrix II, Part B, equal in quantity to that of Part A used, was added to the mixture, which was then immediately spread on the surface of the dried latex film in an amount sufficient to give a layer of about 50 micrometres thick when dry. Immediate application to the rubber film is

necessary because a water-insoluble hydrogel is formed rapidly on mixing Parts A and B of the Aquatrix II. The bulk of the water was removed from the hydrogel by evaporation, after which the plate was placed in an oven at 100 degrees C for 30 minutes to complete vulcanisation of the rubber and to remove any residual water, thus converting the hydrogel into a xerogel (Film 1).

A second film of prevulcanised natural rubber was prepared as described above. This film (Film 2) was not treated with the xerogel/biocide combination but was placed on top of the dried Film 1 and the two films clamped together.

The antimicrobial efficiency of the resulting xerogel/biocide sandwich was tested as follows. Into each well of a 24-well microtitre plate was placed two millilitres of nutrient broth. The combined film was held in a slightly stretched condition on top of it. A sterile suture needle contaminated with a micro-organism was passed through the thickness of the film into a well and allowed to dwell for 30 seconds before removal. When all test wells had been treated, the rubber film was removed, and the microtitre plate covered and incubated for 24 hours at 35 degrees C.

CLAIMS:

1. A thin-walled elastic article which comprises a layer of elastomer with a layer of a xerogel containing a protective agent over at least part of a surface of the elastomer layer.

2. A thin-walled elastic article which comprises two layers of elastomer with a layer of xerogel containing a protective agent sandwiched therebetween.

3. An article according to claim 1, in association with a second thin walled elastic article to be worn or otherwise used over or under the first article with the xerogel layer sandwiched between the elastomer layer and the second article.

4. A thin-walled elastic article according to claim 1 is in the form of a glove, in association with a second article which is a thin-walled elastic second glove worn or to be worn over or under the first glove with the xerogel layer sandwiched between the elastomer layer of the first glove and the second glove.

5. An article according to claim 3 or 4, wherein said second article or second glove comprises a layer of an elastomer.

6. An article according to any of claims 1 to 5, wherein at least one of said layers of elastomer comprise natural rubber latex.

7. An article according to any of claims 1 to 6, wherein the xerogel is cross-linked but still able to imbibe or absorb fluid.

8. An article according to any of claims 1 to 7, wherein the xerogel is a synthetic or semi-synthetic polymer.

9. An article according to claim 8, wherein the xerogel is an electrically neutral polymer or copolymer formed from a hydroxyester of methacrylic or acrylic acid, N-vinyl pyrrolidone, acrylamide, methacrylamide, or an N-alkyl substituted derivative of acrylamide or methacrylamide.

10. An article according to claim 8, wherein the xerogel is an acrylic polymer or copolymer containing charged ionic groups.

11. An article according to claim 10, wherein the xerogel is a polymer or copolymer of a salt of acrylic acid, methacrylic acid, itaconic acid, vinyl sulphonic acid or acrylamido propane sulphonic acid; or the xerogel is a polymer or copolymer of a quaternary ammonium salt of N,N-dimethyl amino ethyl methacrylate or N-vinyl pyridine.

12. An article according to claim 8, wherein the xerogel is polyvinyl alcohol, polyethylene oxide or a segmented polyurethane, or a semi-synthetic carbohydrate polymer.

13. An article according to any of claims 1 to 11, wherein the protective agent is a biocide, a virucide, a bactericide, or a spermicide, or any mixture of two or more thereof.

14. An article according to any of claims 1 to 13, wherein the xerogel layer contains from 0.1 to 80% by weight protective agent.

15. An article according to any of claims 1 to 14, wherein either the article or the second article or both, contain an indicator to give a visible indication of when the article or second article is ruptured.

16. A surgeons' glove substantially as herein described with reference to the accompanying drawing.

17. An article according to claim 1, 2 or 3, which is in the form of a medical or surgical glove, a diaphragm, speculum sheath, endoscope tubing, catheter, shunt, colostomy bag, food storage bag or wrapping material, or a packaging material.

18. A method of making an article as claimed in any preceding claim, which comprises forming on a layer of elastomer, a layer of xerogel containing a protective agent.

19. A method of making an article as claimed in claim 2, which comprises providing, between two layers of elastomer, a layer of xerogel containing a protective agent.

20. The use of a layer of xerogel containing a protective agent as a barrier to fluid flow and/or disease transmission through two thin layers of elastomer, by dispensing the xerogel layer between the elastomer layers.

Fig.1.

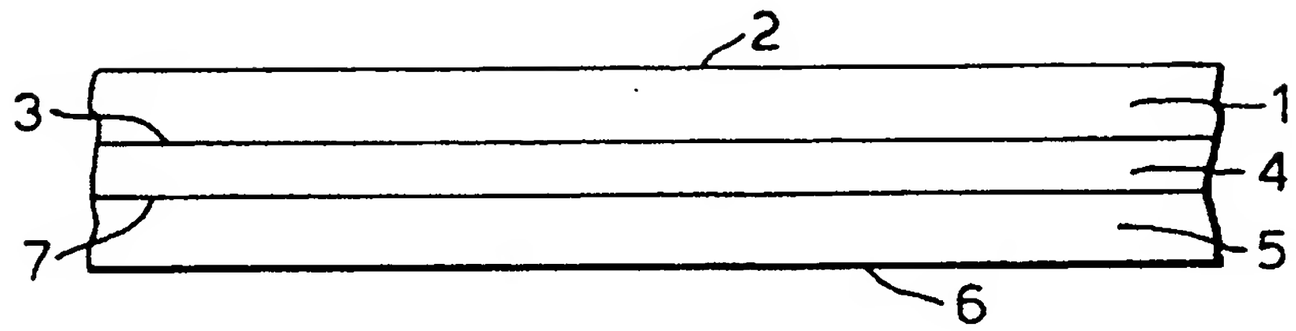


Fig.2.

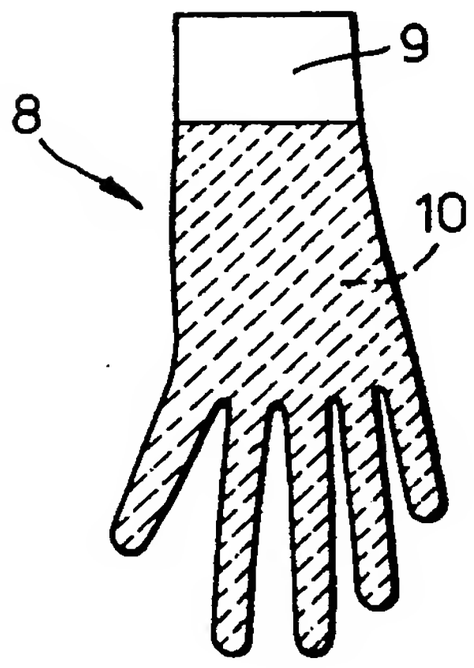
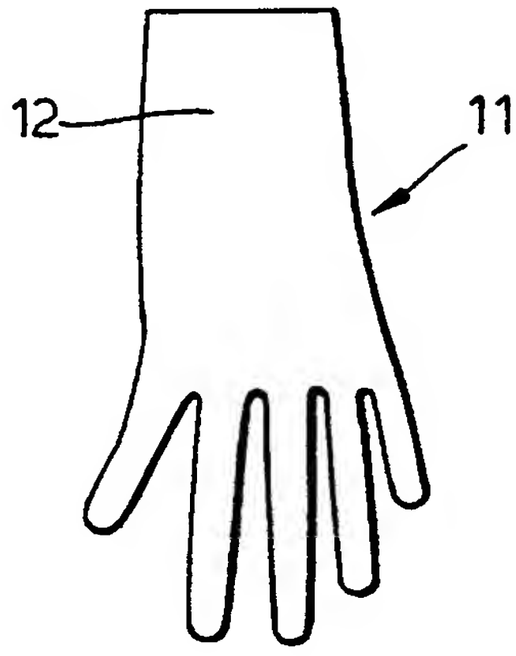


Fig.3.



INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/GB 98/03019

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61L31/00 A61L29/00 A61L25/00 B32B25/04 B32B25/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61L B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and. where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 483 697 A (FUCHS INGBERT E) 16 January 1996 cited in the application see the whole document ---	1-20
X	US 5 549 924 A (SHLENKER ROBIN R T ET AL) 27 August 1996 cited in the application see the whole document ---	1,2,6,8, 13-20
X	EP 0 443 870 A (SHLENKER ROBIN RENEE THILL) 28 August 1991 see the whole document ---	2-6,8, 13-17,20
X	EP 0 780 223 A (HUTCHINSON) 25 June 1997 see figures 1-4 see example 15 --- -/--	2,6-14, 16-20

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure. use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 January 1999	15/02/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Thornton, S

4

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 98/03019

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 23428 A (BAXTER INT) 8 August 1996 see page 13, line 10 - line 17	1,2,6-9, 12-14, 16-19
A	LESLIE LAWRENCE F ET AL: "Needle puncture resistance of surgical gloves, finger guards, and glove liners" J BIOMED MATER RES;JOURNAL OF BIOMEDICAL MATERIALS RESEARCH SPRING 1996, vol. 33, no. 1, April 1996, pages 41-46, XP002091405 see the whole document	1-20
A	WOODS JULIA A ET AL: "Effect of puncture resistant surgical gloves, finger guards, and glove liners on cutaneous sensibility and surgical psychomotor skills" J BIOMED MATER RES;JOURNAL OF BIOMEDICAL MATERIALS RESEARCH SPRING 1996, vol. 33, no. 1, April 1996, pages 47-51, XP002091406 see the whole document	1-20

INTERNATIONAL SEARCH REPORT

...nformation on patent family members

Inter ...nal Application No
PCT/GB 98/03019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5483697 A	16-01-1996	US 5459879 A	24-10-1995
		AU 1250792 A	02-11-1992
		AU 1251792 A	02-11-1992
		AU 1260292 A	02-11-1992
		EP 0579612 A	26-01-1994
		EP 0579613 A	26-01-1994
		WO 9217123 A	15-10-1992
		WO 9217124 A	15-10-1992
		WO 9217125 A	15-10-1992
		US 5486322 A	23-01-1996
		AU 5672790 A	18-12-1990
		WO 9014048 A	29-11-1995
US 5549924 A	27-08-1996	US 5338565 A	16-08-1994
		US 5165953 A	24-11-1992
		US 5130159 A	14-07-1992
		US 5128168 A	07-07-1992
		US 5045341 A	03-09-1991
		US 4935260 A	19-06-1990
		US 4919966 A	24-04-1990
		US 4771482 A	20-09-1988
		US 5679399 A	21-10-1992
		CA 2036790 A	23-08-1991
		EP 0443870 A	28-08-1992
		EP 0299802 A	18-01-1990
EP 0443870 A	28-08-1991	US 5045341 A	03-09-1991
		CA 2036790 A	23-08-1991
		US 5549924 A	27-08-1996
		US 5679399 A	21-10-1997
		US 5130159 A	14-07-1992
		US 5128168 A	07-07-1992
		US 5338565 A	16-08-1994
EP 0780223 A	25-06-1997	FR 2742761 A	27-06-1997
		JP 9277421 A	28-10-1997
WO 9623428 A	08-08-1996	NONE	